Multimodal platform combining optical and ultrasonic technologies for in vivo nondestructive evaluation of engineered vascular tissue constructs

Grant Award Details

Multimodal platform combining optical and ultrasonic technologies for in vivo nondestructive evaluation of engineered vascular tissue constructs

Grant Type: Tools and Technologies III

Grant Number: RT3-07879

Project Objective: Multimodal platform combining optical and ultrasonic technologies for in vivo nondestructive evaluation of engineered vascular tissue constructs

Investigator:

Name:	Laura Marcu
Institution:	University of California, Davis
Type:	PI

Disease Focus: Vascular Disease

Human Stem Cell Use: Adult Stem Cell

Award Value: $1,834,474

Status: Active

Progress Reports

Reporting Period: Year 1

View Report

Grant Application Details

Application Title: Multimodal platform combining optical and ultrasonic technologies for in vivo nondestructive evaluation of engineered vascular tissue constructs

Public Abstract:

Current vascular replacement materials are far from ideal, with all available biomaterials exhibiting significant clinical complications. The development of novel biocompatible decellularized vascular grafts holds great promise for functional restoration of vascular tissues suffering from trauma or disease. However, the need for destructive analysis at multiple in-vitro and in-vivo time points creates a costly critical bottleneck in development of such vascular biomaterials and regenerative medicine approaches. We propose to research, test and validate a tissue diagnostic technology combining optical and ultrasound imaging techniques. This platform will enable label-free, real-time, non-destructive analysis of composition, structure, function and site specific cellular repopulation of extracellular matrix of engineered vascular tissue constructs. This technology is expected to alleviate the need for destructive assays across multiple time points, which are costly and frequently impractical. The technology will facilitate (a) in-vitro rapid screening of vascular scaffold production methods; and (b) in-vivo assessment across multiple time points of vascular constructs. This technology can improve our ability to produce functional engineered vascular tissues in the laboratory for in-vivo implantation which can accelerate the integration time of the vascular implant with the surrounding host tissue, thus to contribute to restoring the desired quality of life to the patient.

Statement of Benefit to California:

Cardiovascular disease is the leading cause of death in western societies (about 1 in 5 deaths); which in combination with the prevalence of peripheral artery disease in aging population (12-20% in individuals >60 years of age) and ischemic stroke due to atherosclerosis of carotid artery make this disease the most prominent health problem in California and in the United States. New therapeutic and diagnostic technologies including advancements in vascular tissue engineering and materials for blood vessel replacement are needed. The proposed multimodal technology has the potential to improve our ability to produce functional engineered vascular tissues in the laboratory and thus to significantly impact treatment for coronary and peripheral artery disease, and to provide solutions for California's citizens greatest health problem. In addition, the global market for vascular grafts and patches is expected to significantly increase over the next 5 years in both United States and Europe due to the prevalence of cardiovascular disease and increased number of interventional vascular procedures. Since both the imaging technology and vascular materials proposed to be evaluated in this CIRM application have potential for commercialization, advancement of this technology has the potential to contribute to California's economic growth. Moreover, a tool for non-destructive label-free engineered tissue analysis as proposed here can accelerate research in all areas of interest to CIRM.
